

## 4.0 DEVELOPMENTAL ANALYSIS

In this section, we analyze the project’s use of the Santee and Cooper rivers’ available water resources to generate hydropower, and estimate the cost of various environmental protection and enhancement measures and the effects of these measures on project economics.

### 4.1 POWER AND ECONOMIC BENEFITS OF THE PROJECT

Under the Commission’s approach to evaluating the economics of hydropower projects, as articulated in *Mead Corporation, Publishing Paper Division*,<sup>28</sup> the Commission employs an analysis that uses current costs to compare the costs of the project and likely alternative power with no forecasts concerning potential future inflation, escalation, or deflation beyond the license issuance date. The basic purpose of the Commission’s economic analysis is to provide a general estimate of the potential power benefits and the costs of a project, and reasonable alternatives to project power. The estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license.

The economic analyses used in this section include various parameters listed in table 17. Using these parameters, we assessed the value of generation output from the facility.

Table 17. Staff parameters for economic analysis of the Santee Cooper Project.  
(Source: Exhibit D of SCPSA, 2004a; staff)

| Parameter                          | Value                   | Sources                     |
|------------------------------------|-------------------------|-----------------------------|
| Power value (2006) <sup>a</sup>    | \$53.00/MWh             | SCPSA (license application) |
| Peak vs. off peak ratio            | All hours average price |                             |
| Period of analysis                 | 30 years                | Staff                       |
| Cost of capital                    | 7.5 percent             | SCPSA (license application) |
| Discount rate                      | 7.5 percent             | SCPSA (license application) |
| Escalation rate                    | 0 percent               | Staff                       |
| Federal income tax rate            | 0 percent               | SCPSA (license application) |
| Local income tax rate <sup>b</sup> | 0 percent               | SCPSA (license application) |
| Term of financing                  | 30 years                | Staff                       |

<sup>28</sup>72 FERC ¶61,027 (1995).

| <b>Parameter</b>            | <b>Value</b> | <b>Sources</b>              |
|-----------------------------|--------------|-----------------------------|
| Insurance                   | \$180,000    | SCPSA (response to AIR)     |
| O&M costs (\$2005)          | \$4,900,000  | SCPSA (license application) |
| Net investment <sup>c</sup> | Not Provided |                             |

- <sup>a</sup> For our analysis we used an average of peak (\$70 per MWh) and off peak (\$36 per MWh) rates for the Virginia/Carolinas power region as reported by Platt's Megawatt Daily for 2005. Because the average annual energy production for the project did not identify a ratio between peak and off peak, we used an unweighted average of \$53 per MWh for the purposes of evaluating project economics.
- <sup>b</sup> SCPSA is a public entity and therefore not subject to income tax and certain other state and local taxes. However, SCPSA indicates that other payments to state and local entities are made in lieu of taxes (i.e., \$13,000,000 in 2002). SCPSA did not indicate what, if any, component of this payment was directly attributable to the day-to-day operation of the project. Therefore, we assumed that any components of this amount that relate to the Santee Cooper Project are included in the O&M costs (averaging \$4.9 million per year) provided in the license application.
- <sup>c</sup> SCPSA did not provide information regarding net investment for the project, but rather provided an amortization of costs based on an assumed principal balance of \$28.8 million for "projected 2006-2025 hydro plant additions" and costs based on an alternative power source. This information does not appear to reflect historical actual project costs or production values, therefore was not used in our analysis.

SCPSA reports that the average annual generation for the 10-year period ending in 1999 was 210,204 MWh at the Jefferies Hydroelectric Station and 13,823 MWh at the Santee Spillway Hydroelectric Station, for a total average annual generation of 224,027 MWh. The annual average generation for the Corps' St. Stephen Project for this period was 301,007 MWh. SCPSA states that the terms of operating Jefferies Station and St. Stephen are governed by a contract with the Corps, which includes provisions for payments to SCPSA from the Corps if energy loss exceeds capacity gain, or payments to the Corps from SCPSA if capacity gain exceeds energy lost, based on the combined operation of the two facilities. SCPSA did not provide information relative to historical payments under this contract that could be used to determine a typical or average net gain or loss in revenue to SCPSA, therefore, we were unable to include the value of this contract as it relates to overall value of the Santee Cooper Project.

SCPSA indicated that the cost of replacement power using gas-fired simple-cycle combustion turbines would be \$20.8 million per year in \$2006. Staff calculates the resulting power value to be \$92.85/MWh based on an annual generation of 224,027 MWh. Though this power value is based on a 2004 estimate of fuel costs of alternative

energy (i.e., natural gas) for 2006, we believe this value is a reasonable estimate of total energy and capacity for measuring the economic benefits of project operation, and for the cost of replacing power for any alternative that would reduce project generation.

#### **4.1.1 No-action Alternative**

Under the no-action alternative, SCPSA would continue to operate the project under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

The estimated average annual generation of the Santee Cooper Project is 224,027 MWh, valued at about \$11,873,000 (53 mills/kWh). The annual cost would be about \$4,900,000 (21.87 mills/kWh) resulting in costs of \$6,973,000 (31.13 mills/kWh) less than the cost of the most likely alternative source of power.

#### **4.1.2 Proposed Action**

For the proposed action, we present the annual cost that includes operating the Santee Cooper Project with the environmental measures SCPSA's proposed in their license application.

Based on the parameters in table 17 and the cost of measures identified in table 18 we estimate that the annual power value under SCPSA's proposed action would be about \$11,884,000 (53.00 mills/kWh) for the estimated annual generation of 223,477 MWh. The annual cost would be \$5,131,000 (22.96 mills/kWh) which is about \$6,713,000 (30.4 mills/kWh) less than the cost of the most likely alternative source of power.

#### **4.1.3 Draft Settlement Alternative**

For the draft settlement alternative we present the annual cost that includes operating the Santee Cooper Project with the environmental measures identified in the DSA.

Based on the parameters in table 17 and the cost of measures identified in table 18 we estimate that the annual power value would be about \$11,705,000 (53.00 mills/kWh) for the estimated annual generation of 220,847 MWh. The annual cost would be \$8,497,000 (38.47 mills/kWh) which is about \$3,208,000 (14.53 mills/kWh) less than the cost of the most likely alternative source of power.

#### **4.1.4 Staff Recommended Alternative**

In this section, we present the annual cost of operating the Santee Cooper Project with staff's recommended measures. The staff's recommended alternative includes certain measures proposed by SCPSA, recommended or required by the agencies, included in the DSA, and recommended by other stakeholders. While we recommend adopting fish passage measures, we also recommend development of a formalized fish

passage implementation plan (see section 3.3.3.2) prior to construction of fish passage facilities. For our analysis, we have incorporated costs for addressing fish passage needs at the project similar to those prescribed by NMFS and proposed by SCPSA, FWS, and SCDNR as part of the DSA.<sup>29</sup> We also recommend additional measures including a recreation management plan and additional provisions relative to shoreline management in concert with the existing CLMP (see section 3.3.5.2).

Based on the parameters in table 17 and the cost of measures identified in table 18, we estimate that the annual value of power for the Santee Cooper Project with environmental measures under the staff alternative would be about \$11,705,000 (53.00 mills/kWh) for the estimated annual generation of about 220,847 MWh. The annual cost would be \$8,547,000 (38.70 mills/kWh) which is \$3,157,000 (14.30 mills/kWh) less than the cost of the most likely alternative source of power.

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<sup>29</sup>In SCPSA's June 7, 2006, filing of alternative fish passage prescriptions, a range of costs were identified for fish passage and protection measures (including mortality and effectiveness studies). SCPSA identified a high range of costs of approximately \$54.8 million to implement the prescribed measures and a low range of \$3.75 million, representing their alternative with reduced or eliminated costs for effectiveness and mortality studies, no upstream fish passage at Santee spillway or Pinopolis dam, and a lower cost for attraction flows at Pinopolis dam. Staff's estimate to provide all the prescribed measures for passage facilities and studies is about \$32.9 million.

Table 18. Summary of annual costs of the proposed and recommended measures for the Santee Cooper Project.  
(Source: SCPSA and staff)

|   | <b>Measures</b>   | <b>Entity</b>            | <b>Capital Cost (\$)</b> | <b>Annual Cost (\$)</b> | <b>Total Annualized Cost (\$)</b> | <b>Adopted by Staff</b> |
|---|---|--------------------------|--------------------------|-------------------------|-----------------------------------|-------------------------|
| 1 | Continue peaking and load regulation operations   | SCPSA                    | \$0                      | \$0                     | \$0                               | Yes                     |
| 2 | Formalize the existing rule curve for reservoir operations  | SCPSA                    | \$0                      | \$0                     | \$0                               | Yes                     |
| 3 | Formalize modified rule curve to maintain full pond levels all year   | American Rivers/CCL, FWS | \$0                      | \$0                     | \$0                               | No                      |
| 4 | Post licensing study of effects of winter draw down on migratory waterfowl and recreational access                        | SCDNR                    | \$30,000                 | \$0                     | \$2,615                           | No                      |
| 5 | Conduct water quality monitoring and remediation, as necessary, in Lake Marion and the Santee River <sup>a</sup>          | SCDNR                    | \$250,000                | \$0                     | \$21,800                          | No                      |
| 6 | Develop water quality enhancement plan with action measures, implementation schedule, and monitoring program <sup>b</sup> | FWS                      | \$250,000                | \$0                     | \$21,800                          | No                      |
| 7 | Improvements to project equipment and operations to meet narrative and numeric state water                                | Forest Service           | N/A                      | N/A                     | N/A                               | No                      |

|    | <b>Measures</b>   | <b>Entity</b>  | <b>Capital Cost (\$)</b> | <b>Annual Cost (\$)</b> | <b>Total Annualized Cost (\$)</b> | <b>Adopted by Staff</b> |
|----|---|--|--------------------------|-------------------------|-----------------------------------|-------------------------|
|    | quality standards   |  |                          |                         |                                   |                         |
| 8  | Consider ways to release a portion of incoming sediments during storm events  | Forest Service   | N/A                      | N/A                     | N/A                               | No                      |
| 9  | Conduct study to evaluate effects of instream flows on dissolved oxygen and temperature <sup>b</sup>  | American Rivers/CCL  | \$250,000                | \$0                     | \$21,800                          | No                      |
| 10 | Continue providing weekly average flow of 4,500 cfs from Jefferies to minimize shoaling in Charleston Harbor and prevent saline waters from reaching Bushy Park industrial complex              | SCPSA, SCDNR, FWS, NMFS, Forest Service, American Rivers/CCL | \$0                      | \$0                     | \$0                               | Yes                     |
| 11 | Continuous flows at St. Stephen - 5,600 cfs from February 1 until April 15th contingent on water availability <sup>c</sup>  | SCPSA, SCDNR, American Rivers/CCL, Staff, NMFS <sup>d</sup>  | \$0                      | \$0                     | \$0                               | Yes                     |
| 12 | Increase continuous minimum flows from Santee dam to 30% of remaining inflow or 1,600, whichever is greater (Feb-Apr), and 25% of remaining inflow or 1,600 cfs, whichever is greater (May-Jan) | SCDNR, FWS, NMFS, American Rivers/CCL                        | \$0                      | \$2,901,000             | \$2,901,000 <sup>e</sup>          | No                      |

|    | <b>Measures</b>  | <b>Entity</b>                                | <b>Capital Cost (\$)</b> | <b>Annual Cost (\$)</b> | <b>Total Annualized Cost (\$)</b> | <b>Adopted by Staff</b> |
|----|--|--|--------------------------|-------------------------|-----------------------------------|-------------------------|
| 13 | Increase to minimum release of 2,600 cfs from Santee dam to maintain above the record low flow in the Santee River                               | Forest Service                               | \$0                      | \$3,556,700             | \$3,556,700 <sup>f</sup>          | No                      |
| 14 | Increase continuous minimum flows at Santee dam to 2,400 (February – April) and 1,200 (May – January)  | SCPSA, FWS, SCDNR                            | \$0                      | \$1,581,000             | \$1,581,000 <sup>g</sup>          | Yes                     |
| 15 | Provide one annual flushing release of 40,000 cfs from Santee dam to accommodate sediment transport <sup>h</sup>                                 | Forest Service                               | \$0                      | \$0                     | \$0                               | No                      |
| 16 | Develop a Drought Contingency Plan for the operation of the project during low inflows and/or drought <sup>i</sup>                               | SCPSA, SCDNR, American Rivers/CCL, FWS, NMFS | \$100,000                | \$10,000                | \$18,700                          | Yes                     |
| 17 | Develop an Adaptive Management Program to assess the effectiveness of flow alternatives in providing aquatic habitat and navigation <sup>j</sup> | American Rivers/CCL                          | \$500,000                | \$0                     | \$43,600                          | Yes                     |
| 18 | Form a Technical Advisory Committee for Instream Flows   | SCPSA, FWS, SCDNR                            | \$0                      | \$0                     | \$0 <sup>k</sup>                  | Yes                     |
| 19 | Increased locking operations for   | SCPSA  | \$0                      | \$29,150                | \$29,150                          | Yes                     |

|       | <b>Measures</b>   | <b>Entity</b>  | <b>Capital Cost (\$)</b> | <b>Annual Cost (\$)</b> | <b>Total Annualized Cost (\$)</b> | <b>Adopted by Staff</b>                                    |
|-------|---|--|--------------------------|-------------------------|-----------------------------------|--|
|       | fish passage at Pinopolis lock - a minimum of 6 per day, when water conditions permit <sup>1</sup>  |  |                          |                         |                                   |  |
| 20    | Construct fish passage and protection measures, including pre-design studies, facility design, and post- construction effectiveness testing. <sup>m</sup> The following provides estimated costs for the major fish facilities that are included within the total capital cost shown. | SCPSA,<br>SCDNR,<br>FWS, Forest Service,<br>NMFS,<br>American Rivers/CCL | \$32,900,000             | \$37,000                | \$3,238,000                       | Yes  |
| 20(a) | Install new fish counting technology at Pinopolis lock and conduct effectiveness testing  | SCPSA,<br>SCDNR,<br>FWS, Forest Service,<br>NMFS,<br>American Rivers/CCL | \$420,000                | \$0                     | \$36,460                          | Yes  |
| 20(b) | Construct upstream fish lift/elevator at Jefferies powerhouse for alosids and sturgeon, if passage at Pinopolis lock is determined inadequate   | SCPSA,<br>SCDNR,<br>FWS, Forest Service,<br>NMFS,<br>American            | \$5,700,000              | \$60,000                | \$556,880                         | Yes,<br>pending<br>Pinopolis<br>lock<br>effective-<br>ness |

|       | <b>Measures</b>  | <b>Entity</b>  | <b>Capital Cost (\$)</b> | <b>Annual Cost (\$)</b> | <b>Total Annualized Cost (\$)</b> | <b>Adopted by Staff</b> |
|-------|--|--|--------------------------|-------------------------|-----------------------------------|-------------------------|
|       |  | Rivers/CCL   |                          |                         |                                   | study                   |
| 20(c) | Construct upstream eel ladders at Jefferies                                  | SCPSA, SCDNR, FWS, Forest Service, NMFS, American Rivers/CCL | \$360,000                | Included in Item 20b    | \$31,400                          | Yes                     |
| 20(d) | Conduct alosid and sturgeon population study in lower Santee River           | SCPSA, SCDNR, FWS, Forest Service, NMFS, American Rivers/CCL | \$300,000                | \$0                     | \$26,000                          | Yes                     |
| 20(e) | Construct upstream fish lift/elevator at Santee dam for alosids and sturgeon | SCPSA, SCDNR, FWS, Forest Service, NMFS, American Rivers/CCL | \$2,198,000              | \$51,000                | \$242,600                         | Yes                     |
| 20(f) | Construct upstream eel ladders at Santee dam                                 | SCPSA, SCDNR, FWS, Forest                                    | \$200,000                | Included in Item 20e    | \$17,400                          | Yes                     |

|       | <b>Measures</b>  | <b>Entity</b>   | <b>Capital Cost (\$)</b> | <b>Annual Cost (\$)</b>     | <b>Total Annualized Cost (\$)</b> | <b>Adopted by Staff</b>         |
|-------|--|---|--------------------------|-----------------------------|-----------------------------------|---------------------------------|
|       |  | Service, NMFS, American Rivers/CCL                            |                          |                             |                                   |                                 |
| 20(g) | Conduct monitoring studies for downstream passage  | SCPSA, SCDNR, FWS, Forest Service, NMFS, American Rivers/CCL  | \$700,000                | \$0                         | \$61,000                          | Yes                             |
| 20(h) | Install full depth bar racks and bypass systems at Santee and Jefferies stations for downstream passage and protection | SCPSA, SCDNR, DFWS, Forest Service, NMFS, American Rivers/CCL | \$9,061,000              | Included in Items 20b & 20e | \$790,000                         | Yes, pending monitoring studies |
| 20(i) | Develop fish passage implementation plan   | FWS   | \$75,000                 | \$15,000                    | \$21,500                          | Yes                             |
| 21    | Install manatee exclusion devices at Pinopolis lock  | SCPSA   | \$500,000                | \$0                         | \$43,590                          | Yes                             |
| 22    | Manage aquatic nuisance and invasive plants adjacent to or encroaching the Santee NWR <sup>n</sup>                     | SCDNR, FWS  | \$25,000                 | \$10,000                    | \$12,600                          | Yes                             |

|    | <b>Measures</b>  | <b>Entity</b> | <b>Capital Cost (\$)</b> | <b>Annual Cost (\$)</b> | <b>Total Annualized Cost (\$)</b> | <b>Adopted by Staff</b> |
|----|--|---------------|--------------------------|-------------------------|-----------------------------------|-------------------------|
| 23 | Develop and implement a Red-Cockaded Woodpecker Management Plan for Persanti Island  | SCDNR, FWS    | Included in Item 22      | Included in Item 22     | -                                 | Yes                     |
| 24 | Develop a Recreation Plan and update every 10 years for the life of the license <sup>o</sup>   | SCDNR         | \$25,000                 | \$5,000                 | \$7,180                           | Yes                     |
| 25 | Provide recreational enhancements of an additional classroom at Old Santee Park and picnic shelters and paved parking at Overton Park                          | SCPSA         | \$100,000                | \$5,000                 | \$13,717                          | Yes                     |
| 26 | Install mooring piers at several locations and construct a two-lane boat launch at Richard Landing at White Point  | SCPSA         | \$375,000                | \$8,000                 | \$40,700                          | Yes                     |
| 27 | Provide improved bank fishing access and parking, an additional boat navigation channel across Lake Marion, and reflective markings and/or lights <sup>p</sup> | SCDNR         | \$125,000                | \$5,000                 | \$15,900                          | No                      |
| 28 | Mark and snag a new navigation channel in Jack's Creek   | SCPSA, FWS    | Included in Item 27      | Included in Item 27     | -                                 | Yes                     |
| 29 | Develop a Shoreline Management   | SCDNR,        | \$30,000                 | \$110,000               | \$112,600                         | Yes                     |

|    | <b>Measures</b>   | <b>Entity</b> | <b>Capital Cost (\$)</b> | <b>Annual Cost (\$)</b> | <b>Total Annualized Cost (\$)</b> | <b>Adopted by Staff</b> |
|----|---|---------------|--------------------------|-------------------------|-----------------------------------|-------------------------|
|    | Plan incorporating existing CLMP programs and update the plan every 10 years for the life of the license <sup>o</sup> | SCPSA         |                          |                         |                                   |                         |
| 30 | Designate Polly-Cantey Bay as a “natural area” under the CLMP   | FWS           | Included in Item 29      | Included in Item 29     | -                                 | Yes                     |
| 31 | Prepare a PA that would be incorporated by reference into the project license.  | SCPSA         | \$20,000                 | Included in Item 29     | \$1,700                           | Yes                     |
| 32 | Pepare an HPMP to guide SCPSA's management of the project's historic properties during the term of the license        | SCPSA         | Included in Item 31      | Included in Item 29     | -                                 | Yes                     |

- <sup>a</sup> Assumes 5 years of data collection and reporting at \$50,000 per year at 15 locations, as were analyzed by SCPSA during relicensing to characterize water quality conditions at the project.
- <sup>b</sup> Assumes an effort equivalent to that identified for the SCDNR recommended water quality enhancement and monitoring plan.
- <sup>c</sup> Assumes no cost to SCPSA because flows could not be otherwise used for generation at Santee or Jefferies stations.
- <sup>d</sup> Recommendations for the timing of releases were variable between recommending entities. The timeframe included represents that proposed by SCPSA and recommended by staff.
- <sup>e</sup> This value represents a loss of 55,000 MWh at a power value of \$53/MWh at St. Stephen for this minimum flow alternative.

- <sup>f</sup> This value represents a loss of 5,470 MWh at Jefferies and 61,640 MWh at St. Stephen at a power value of \$53/MWh.
- <sup>g</sup> This value represents a loss of 2,630 MWh at Jefferies and 27,200 MWh at St. Stephen at a power value of \$53/MWh.
- <sup>h</sup> Flushing flows at the level suggested by the Forest Service occur naturally during flood conditions and are passed by the project, therefore, we do not consider this measure to result in additional costs, if implemented.
- <sup>i</sup> Capital cost assumes \$125,000 to develop a formal water use model and plan and \$25,000 of agency consultation through a series of meetings and negotiations. Annual cost assumes annual coordination efforts to forecast water availability, corresponding use of allocation information, and distribution/consultation with agencies and the public.
- <sup>j</sup> Assumes \$50,000 year for 10 years to monitor aquatic habitat conditions in the Santee bypass including periodic DO measurement and quantification of fish and wildlife habitat and population observations.
- <sup>k</sup> Assumes costs associated with this measure would fall under other related activities including the Adaptive Management Plan and Drought Contingency Plan.
- <sup>l</sup> Cost assumes lost generation potential of 550 MWh associated with use of approximately 8,900 acre-feet of water from February through April, and a power value of \$53/MWh.
- <sup>m</sup> Our estimated costs include measures similar to those prescribed, but also include pre-design studies, engineering design, and permitting; construction costs for upstream and downstream passage facilities at both Jefferies station and Santee dam, including estimated energy losses from shutdowns during construction; and 3 years of post-construction effectiveness studies. For the purposes of evaluating project net benefits, we used our estimated costs rather than the estimated range of costs of prescribed measures (\$54 million) or alternative prescription (\$3.75 million) presented in SCPSA's June 7, 2006, filing for trial type hearing.
- <sup>n</sup> Assumes limited effort to formalize a plan around existing nuisance plant control efforts, and an annual cost to conduct an annual survey of existing information.
- <sup>o</sup> Assumes limited effort to develop the plan due to availability of existing information. Primary effort needed would be to identify triggers for the timing and potential locations of future facilities.
- <sup>p</sup> Capital cost includes construction of five fishing access and parking area locations at \$15,000 each, and \$50,000 to install 40 solar powered marker buoys.

## 4.2 COST OF ENVIRONMENTAL MEASURES AND ECONOMIC COMPARISON OF ALTERNATIVES

Table 19 presents a summary of the current annual net benefits for no action, the proposed action, the draft settlement, and staff's recommended alternative.

Table 19. Summary of annual net benefits of the alternatives for the Santee Cooper Project. (Source: Staff)

| <b>Parameter</b>        | <b>No-Action Alternative</b> | <b>Proposed Action</b> | <b>DSA Alternative</b> | <b>Staff Alternative</b> |
|-------------------------|------------------------------|------------------------|------------------------|--------------------------|
| Annual generation (MWh) | 224,027                      | 223,477                | 220,847                | 220,847                  |
| Installed capacity (MW) | 130                          | 130                    | 130                    | 130                      |
| Annual power value (\$) | \$11,873,000                 | \$11,844,000           | \$11,705,000           | \$11,705,000             |
| Mills/kWh               | 53.00                        | 53.00                  | 53.00                  | 53.00                    |
| Annual cost (\$)        | \$4,900,000                  | \$5,131,000            | \$8,497,000            | \$8,547,000              |
| Mills/kWh               | 21.87                        | 22.96                  | 38.47                  | 38.70                    |
| Annual net benefit (\$) | \$6,973,000                  | \$6,713,000            | \$3,208,000            | \$3,157,000              |
| Mills/kWh               | 31.13                        | 30.04                  | 14.53                  | 14.30                    |